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ABSTRACT

This paper describes performance-based assessment of beginning science teachers who are seeking provisional teaching certificates in Connecticut. The assessment is part of the Science Education Support and Assessment Program (SESAP). The project attempts to turn a summative licensing assessment into a formative instrument to improve science teaching and learning. The SESAP program is based on a model of beginning teacher growth that considers first-year teachers as learners in a development stage; second-year teachers as learners and researchers in an inquiry stage; and third-year teachers as learners, researchers, and professionals. Assessment is regarded as an opportunity to learn, and the system is designed to give teachers an opportunity to present their teaching and reflect on it with a mentor. In the first year teachers are invited to professional meetings in which they learn how to document and analyze their teaching. This leads teachers to the development of teaching portfolios that are scored and evaluated around specific dimensions of teacher knowledge. Four appendixes describe the SESAP system, guidelines for portfolio construction, dimensions of knowledge for teacher assessment, and professional science teaching standards. (SLD)

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Students, Teachers, Science and Performance Assessment

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Introduction

This paper describes performance-based assessment of beginning science teachers who are seeking provisional teaching certificate in Connecticut. The assessment is part of the Science Education Support and Assessment Program (SESAP), which was developed by the Connecticut State Department of Education (1993 - current), together with practicing science educators from public schools and universities in Connecticut. This project attempts to turn a summative licensing assessment into a formative instrument to improve science teaching and learning.

Overview of Induction programs for Beginning Science Teachers in Connecticut

The first two to three years of a teacher's career represents a critical formative period in the development of teaching styles and strategies. In order to be effective, beginning teachers must not only develop basic classroom management and instructional skills necessary to function in the classroom, but they must also acquire a deeper understanding of the discipline they teach and the ways in which students learn this discipline. We believe that successful induction of beginning teachers into their profession requires that these teachers receive significant support and training during this period. Assessment and evaluation of beginning teachers, therefore, should serve not only for the purpose of accountability and certification, but also to inform the support system and facilitate the growth of these teachers. By clearly delineating what effective teaching is (articulated through science teaching professional standards), by creating the means to determine how close each teacher comes to expected performance criteria (developing teaching portfolios) and by providing formative feedback and needed training (assessment of performance and continuous staff development), the induction program can promote teacher professional growth and successful student learning.

In recognition of the importance of the initial teaching experience, the Connecticut State Department of Education (CSDE) is developing new models of support and assessment as alternatives to the current Beginning Educator Support and Training (BEST) Program. Instead of a one-year general teaching induction program, CSDE proposes a two- to three-year period of content-focused support and assessment for beginning teachers. The Science Educator Support and Assessment Program (SESAP) is one such initiative which will be under development for the next several years. This induction program will serve as an extension of the teacher's pre-professional education, in which previous learning and present experiences are incorporated into a mature, reflective teaching practice.

Why do teachers need an extended period of induction into the profession? The answer to this question lies in the complex, reciprocal nature of the teaching/learning process. Although prospective teachers complete a course of study of specific content and educational theory, they have limited opportunities to be engaged in the actual act of teaching. Only after entering the classroom do teachers begin to understand that students are a group of individual learners who bring different skills, knowledge, needs and interests into the learning process. Only after committing themselves to classroom teaching, do teachers begin the long process of learning how to transform their own knowledge of science into a coordinated set of learning activities that are relevant, accessible and meaningful to their students.

To facilitate the growth of beginning teachers as professionals we suggest a continuum of support, training and assessment that is aligned with the following **model** of teacher professional growth (Lomask, 1993):

First year - Teachers as learners (development stage)

a. **Development** of a personal teaching style that is comfortable and effective
b. **Exploration**, through reflective documentation, the effects of various learning materials and teaching methods on student learning
c. **Collaboration** with peer teachers and other school professionals who share similar goals and dilemmas

Second year - Teachers as learners and researchers (inquiry stage)

a. **Documentation** of classroom teaching experiences and students' progress toward targeted learning performances

b. **Articulation** of specific questions about self-experience with teaching

c. **Exploration** of answers to those specific questions through discussions with peer teachers, with mentoring teams or at regional meetings

d. **Deliberation** and critical examination of professional teaching practice

Third year - Teachers as learners, researchers and professionals (career enhancement)

a. **Identification** of individual educational needs and the ways these needs might be met (e.g., updating knowledge of subject matter, improving skills of cooperative learning instruction).

b. **Accomplishment** of specific tasks to improve individual and peer teaching (e.g., graduate courses, local workshops, national conferences).

The SESAP induction program is tailored to fit the above model of teaching development:

- During the first year of teaching, beginning teachers focus on the development of fundamental teaching skills, such as class management and smooth instructional transitions. Their competency in performing these basic teaching skills is evaluated by their school administrators. Along with the school administration attestation, teachers begin to focus on additional teaching skills, such as attention to learners' diversity and the development of a challenging, yet supportive learning environment. Teachers are encouraged to try new learning activities with their students, with support and friendly critiques from administrators and peer teachers. They are offered professional development opportunities (see Appendix A), in which they can share and reflect upon their documented experiences. In their first year of teaching, beginning science teachers develop a small-scale teaching portfolio which represents their practice in this first year. This portfolio is reviewed by science teachers in the school, together with the beginning teacher and trained portfolio assessors.

- During the second year of teaching, beginning teachers focus their attention on students as learners and the development of content-based pedagogical knowledge and skills necessary to facilitate students' learning. Teachers are asked to identify and deal with specific problems that they encounter in their daily teaching. In various mentoring arrangements, teachers are given the opportunity to work with experienced teachers and other professionals, teaming up to find solutions to current problems. At the end of their second year of teaching, teachers submit a comprehensive portfolio of their work, for evaluation by trained State assessors. Interviews, designed for elaboration and professional feedback, follow the review of the portfolio. Teachers that submit portfolios that do not meet certain performance standards, might be provided another opportunity to complete this work in their third year of teaching.

- We trust that during the third year, most teachers will be able to pursue individual career goals and become engaged in various professional activities (including taking a part in mentoring teams for new teachers), that will set the stage for a life-long career of successful and rewarding teaching practice.

Developing Professional Teaching Standards

Efforts to assess the quality of performance, in any given field, begin with setting professional standards for the expected performances in this field. In the broadest sense, a standard is something used as a basis for comparison, either to determine accuracy, estimate quantity, or judge quality. Professional teaching standards may take the form of requirements established by educators, or performance norms that were developed and approved by professions. Assessment of the quality of performance in any field, be it music, architecture, teaching or learning, is based on the specific standards that each profession has developed and adopted over time. For our purposes, **professional teaching standards** take the form of declarative and descriptive statements, representing practices, attitudes and knowledge that communicate a vision and are at the forefront of current thinking in the field of science education. Standards for teachers describe what teachers should know and do, and they organize teaching practice into clusters of critical phases of teaching, such as planning, teaching, assessment and reflection. The Science Teaching Standards which were developed in this program are described in Appendix D.

The science teaching standards for school science were developed by a committee of science educators from various backgrounds. In the process of developing these standards, the committee felt that there was a need to develop "standards for developing teaching standards," to set generic criteria to guide the development and evaluation of the emerging teaching standards. The science committee has used the following criteria for standards evaluation:

- Teaching standards describe a vision for teaching and learning
- Teaching standards reflect teaching as a process of continuous learning
- Teaching standards reflect national, as well as local, school reform efforts
- Teaching standards are designed for diverse teacher and student populations
- Teaching standards should lead to a flexible and resourceful teaching style

Assessment of Teaching

The SESAP adopts the notion of assessment as an opportunity to learn, for students and teachers as well. As a result we tried to develop an assessment system that gives teachers an opportunity to present their teaching and reflect upon it with a mentor. To achieve this goal we developed a comprehensive program of support and assessment for beginning teachers, that covers a period of two to three years. The program is designed to meet the professional needs of beginning teachers in different phases of their early career development. In the first year teachers are invited to a series of five professional meetings, in which they learn how to document teaching (in writing and by videos), how to analyze teaching and how to evaluate the effectiveness of their teaching. These meetings focus on work and documentation done by the participating teachers themselves and it leads the teachers toward the development of *teaching portfolios*. A short summary of the SESAP guidelines for portfolio development is described in Appendix B.

The scoring and evaluation of the teaching portfolio is done around specific dimensions of teachers' knowledge, which reflect the specific professional teaching standards (see Appendix C). The evaluation is followed by a formative feedback, delivered by a face-to-face interview with the assessor and a written document that suggests foci for future professional growth, tailored individually for each beginning teacher.

The unique features of this teacher assessment program are:

- Inclusive - assess different dimensions of knowledge, skills and dispositions that are relevant to effective teaching
- Essential - judge teacher effectiveness on the basis of their students' learning
- Contextual - focus on the work of teachers in their own classroom
- Scorable - elicit dimensions of teaching that can be articulated and measured
- Practical - provide formative feedback to individual teachers
- Educational - guide the school-based support systems

Description of the Whole Assessment System

Assessment of beginning science teachers in Connecticut, leading to a provisional teaching certificate, is currently composed of three components:

Component 1 - Classroom-based Observations

Beginning teachers are observed and guided by local school evaluation formats to ensure mastery of **basic teaching skills**. The Connecticut Competencies Indicators (CCI) assessment instrument is usually used by administrators in classroom observation-based evaluations of teachers. The CCI is not a content-specific assessment, rather it assesses generic teaching skills such as opening and closure, questioning techniques, transitions and monitoring.

Component 2 - Assessment of School Lab Safety Awareness

Beginning science teachers are required to participate in the Interactive Video Disc (IVD) Safety Simulator assessment during the second half of their first year of teaching. This interactive lab simulator serves as a tool for assessing teachers knowledge of **lab safety management.** Details about the content and format of this assessment task are described in Lomask, Jacobson and Hefner (1993).

Component 3 - Portfolio-Based Assessment of Teaching and Learning

During their second year of teaching, science teachers are required to construct and submit a teaching portfolio that documents their teaching and their students' learning over a period of 2 to 3 weeks. Teachers are strongly encouraged to collaborate with their mentors and/or other teachers in their content area, during the process of portfolio construction. The general format of the teaching portfolio is presented in the following pages. More details are provided in the Guidelines for Developing Teaching Portfolios (CT State Dept. of Education, 1994).

Request for publications about this program should be addressed to:
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Appendix A
SESAP - Support of Beginning Teachers

The support is composed of five seminars, each of them is focused on the development of specific skills and understanding. The support sessions are based on materials produced by the teachers in their classes, such as videos of teaching, lesson logs and students' work.

Seminar I
Orientation to the program.

Seminar II
Learning to develop sound teaching practice through identification of personal beliefs about teaching science and review of these believes in light of the Professional Teaching Standards.

Seminar III
Learning to develop and use performance tasks to assess various dimensions of students' learning in science

Seminar IV
Learning to develop scoring dimensions and criteria to evaluate students' progress and identify specific obstacles to their learning

Seminar V
Learning to write formative feedback to students and changing teaching practice in accordance to findings about students' learning.

Appendix B

General Guidelines for Constructing Teaching Portfolios

Part 1: Planning a Unit of Learning

This section of the portfolio should elicit evidence of the teacher's knowledge of his/her students (academic backgrounds, learning dispositions, class culture, etc.), the subject matter students are supposed to learn and the way instruction can be organized to facilitate students' learning. In this section you should focus on the following issues:

a. What do I want my students to know and be able to do in this specific unit?
b. Why is this important for my students to know?
c. What previous knowledge, skills, culture and needs do my students have and how do I plan to address student diversity?
c. In what specific learning activities will my students be engaged to facilitate their learning?

Part 2: Teaching and Building a Positive Learning Environment

This section of the portfolio should document in detail (written and videotaped descriptions) a specific learning activity in which the students were engaged during the unit. This section should focus on the following aspects of the learning environment:

a. What kind of discourse and learning environment did I foster in my class to facilitate students' work and understandings of main concepts and processes?
b. How did instruction support the development of connections among main concepts?
c. How was the class organized during hands-on activities, to foster a safe and supportive learning environment?
d. How can I improve the learning activities to further facilitate students' learning?

Part 3: Assessing Student Learning

This section of the portfolio should provide documentation and a commentary about the assessment of students' knowledge, understandings and skills during the described learning unit. The commentary should focus on the following issues:

a. What types of assessment did I use to elicit and promote students' learning?
b. What did I learn about my students' understanding of targeted concepts and skills?
c. How can I improve my assessment to learn more about my students' learning?

Part 4: Analyzing and Reflecting on Teaching

This section of the portfolio should summarize the teacher's experience with this learning unit. It should document the teacher's ability to reflect on and analyze his/her teaching practice and answer three main questions:

a. What did I learn from this unit about my students as learners of science?
b. What did I learn from this unit about myself as a teacher of science?
c. How will I adapt my teaching in the future, based on this experience?
d. How did professional encounters with peers and other resource persons help me shape my teaching?

Appendix C

Dimensions of Knowledge for Teacher Assessment

(Serve as a basis for scoring and evaluation of teachers' portfolios)

Knowledge of Students as Learners of Science

- What does the teacher know about his/her students and what measures has s/he taken to meet these students' needs and interests?

Knowledge of Science as a Discipline

- How does the teacher demonstrate understanding of the nature, content, connections and applications of science?

Knowledge of Science Teaching

- In what ways does the teacher build a learning environment conducive to science learning and how does s/he encourage all students to construct scientific literacy?

Professionalism and Leadership

- What does the teacher do to become a science leader in the school and a professional member in the larger community of science education?

Appendix D

Professional Science Teaching Standards

I. Planning for Students' Learning

- **Understanding Student Learning**

Science teachers understand that how cognitive, affective and social factors affect student learning. They design flexible instruction that is responsive to students' experiences, needs and interests, to create relevant and challenging learning activities for all learners.

- **Understanding Science**

Science teachers understand the nature and content of science and its connections to other disciplines. They reflect this knowledge by creating opportunities for students to explore major science issues, helping students achieve local and/or national science program goals.

- **Science Literacy**

Science teachers understand the significance of science literacy for active participation in today's society. They design instruction to support development of scientific understanding, logical reasoning and informed decisionmaking about science, technology and society issues.

- **Contexts of Science**

Science teachers understand the interdisciplinary nature of science. They create opportunities for students to examine the contexts of science, including its history, reciprocal relationship with technology, ties to mathematics and impacts on and by society.

II. Facilitating Students' Learning

- **Inclusion**

Science teachers understand that all students have the potential to learn and be successful in the pursuit of understanding science. They search for instructional modes that motivate and encourage all of their students to actively participate in the learning of science.

- **Learning Environment**

Science teachers understand that the science classroom should resemble a science community. They create a safe learning environment in which teacher and students ask questions and explore science in various thoughtful, creative and cooperative ways.

- **Instructional Resources**

Science teachers understand that not all students learn in the same way. They use a variety of subject matter representations, instructional modes and educational technologies to support students' learning and explorations of ideas.

- **Student Assessment**

Science teachers understand that assessment has to be congruent with instruction. They gather data on students' learning through various assessments that offer students opportunities to explore and document their own learning.

III. Reaching In: Reflecting on Students' Learning

- **Reflective Practice**

Science teachers understand that student learning is the goal of their teaching. They continuously evaluate their teaching practice through analyses of student work, in order to improve the quality of students' learning.

- **Continual Learning**

Science teachers understand that being a teacher means being a scholar of human learning. They identify their own learning needs and take active steps to strengthen their knowledge of science and their understanding of students as learners of science.

IV. Reaching Out: Supporting Students' Learning

- **Collegiality**

Science teachers understand that they are part of a community of learners. They seek the advice of other professionals and they contribute to the quality of their colleagues' practice and to the work of the larger educational community.

- **Family and Community Outreach**

Science teachers understand the significant influence of the larger community on student learning. They routinely involve families and other members of the community to best serve the interests of each student.